

University at Buffalo The State University of New York
 

THE DEPARTMENT OF CIVIL, STRUCTURAL AND ENVIRONMENTAL ENGINEERING

BRIDGE ENGINEERING PROGRAM

Distinguished Speaker Series

**Roles and Responsibilities of the
Federal Highway Administration
(FHWA)**

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 FHWA Office of Bridge Technology
 U.S. Department of Transportation
 Washington, DC


University at Buffalo The State University of New York
 

THE DEPARTMENT OF CIVIL, STRUCTURAL AND ENVIRONMENTAL ENGINEERING

Topics Covered

- Introduction – Historic Perspective
- Visions of Our Leaders in Transportation
- United States Code of Laws
- National Highway Bridge Program
- Challenges and Opportunities in Bridge Engineering

Introduction – Historic Perspective



**FEDERAL-AID HIGHWAY PROGRAM
1916-1921**


- Federal-State partnership.
- **Each State must have a highway agency.**
- 50-50 Federal-State funding for projects.
- **Projects on designated system.**
- Federal review of each project.




**ORIGINS OF THE INTERSTATE
SYSTEM**



**President Dwight D. Eisenhower
1953 - 1961**



“Broader Ribbons Across the Land”



Federal-Aid Highway Act of 1956

- ☞ National Commitment to Build the Interstate System.
- ☞ Retained Federal-State partnership.
- ☞ Funding source: Highway Trust Fund.
- ☞ Cost-to-Complete Guarantee.
- ☞ High Design Standards.

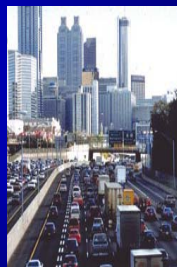


U.S. DEPARTMENT OF TRANSPORTATION

- ☞ President Lyndon Johnson signed legislation to establish USDOT in 1966.
- ☞ Formal Opening on April 1, 1967
- ☞ FHWA formally opened on same day.
- ☞ States began to establish State DOTs



Eisenhower System of Interstate and Defense Highways



“Safe, Reliable and Efficient Interstate System”

U.S. Department of Transportation



Secretary
Ray LaHood

Safety
Economic Health
Sustainability
Livability



Deputy Secretary
John Porcari



Sustainable Highway Programs

- ☞ Investments in the programs
- ☞ Better roads, bridges and tunnels
- ☞ Reduce CO₂ emission
- ☞ Consider carbon absorbing materials
- ☞ Adapt to effects of climate changes
- ☞ Avoid negative impact to the environment



Sustainable Highway Programs (continued)

- ☞ Use of recycled materials
- ☞ Use of high performance materials:
 - HPC, SCC, HPS, UHPC
- ☞ Increase durability and reliability
- ☞ Minimize maintenance needs
- ☞ Reduce life-cycle costs
- ☞ Improve safety and efficiency




Livable Communities

- ☞ Safer and healthier communities
- ☞ Strong economies to support jobs and families
- ☞ Interconnected transportation modes and systems
- ☞ Sustainable mobility – encourages walking, biking and public transportation




Federal Highway Administration (FHWA)




Victor Mendez
Administrator

"Every Day Counts" Initiatives

- Project Delivery
- Innovations
- Going Greener



Greg Nadeau
Deputy Administrator



Accelerated Bridge Construction

- ☞ Fast track process
- ☞ Prefabricate bridge elements and systems
- ☞ Construct elements and systems off-site
- ☞ Lift, slide or swing into place
- ☞ Reduce on site construction time and traffic impact





TECHNOLOGY & INNOVATION

Prefabricated Bridge Elements & Systems

Prefabricated bridge elements and systems manufactured on-site or off-site, under controlled conditions, and brought to the job location ready to install

Benefits:

- ▶ Minimizes traffic & community impact
- ▶ Improves construction zone safety
- ▶ Increases quality & lowers life-cycle costs






TECHNOLOGY & INNOVATION

Geosynthetic Reinforced Soil

Benefits:

- ▶ Eliminates approach slab or Construction joint
- ▶ Reduced construction time
- ▶ Cost effective
- ▶ Less dependent on weather conditions
- ▶ Easier to maintain
- ▶ Built with common equipment, materials, and labor





Prefabricated Bridge Success Stories

Deck Replacement



Superstructure Replacement



Precast Bent Cap Substructure



A few examples...





Federal Highway Administration (FHWA)

Jeffrey F. Paniati
Executive Director

Strategic Goals:

- National Leadership
- Program Delivery
- System Performance
- Corporate Capacity

John Baxter
Associate Administrator
for Infrastructure

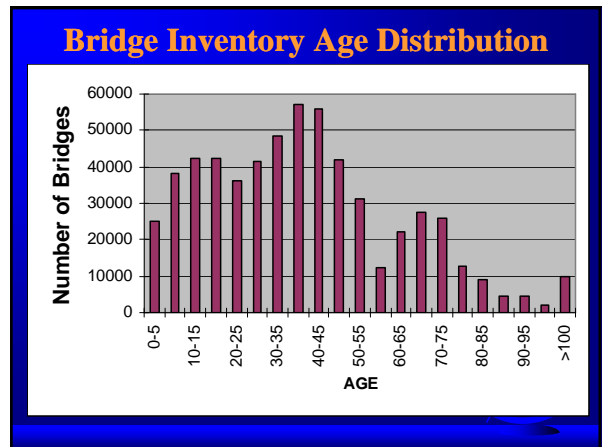
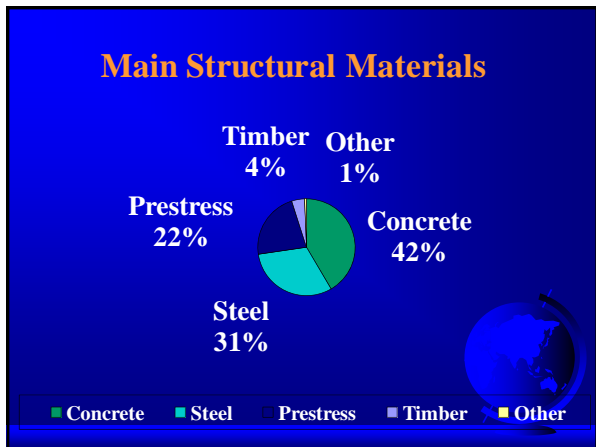
Federal Highway Administration FHWA

The U.S. Highway System:

- 160,000 miles of Highways in the National Highway System (NHS).
- 4,000,000 miles of road in the Non-NHS – urban and rural roads
- 47,000 miles of Interstate System
- 600,000 highway bridges

Bridge Ownership

Owners	By Number	By Deck Area
States	48%	76%
Locals	50%	23%
Federal	2%	1%
Others	0%	0%



Our Vital Few Priorities

- ☞ Safety
 - 34,000 fatalities annual

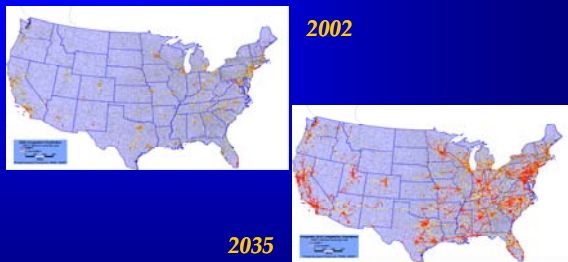


Our Vital Few Priorities

- ☞ Congestion Mitigation
 - Highway travel continues to grow



Congested Highways



Heavy Truck Routes



Our Vital Few Priorities

- ☞ Environmental Stewardship and Streamlining
 - Protect and enhance the environment



Concepts of “Green Bridges”



United States Code of Laws (U.S.C.)

- ☞ Congress makes the laws
- ☞ **General and Permanent Laws are codified in U.S.C.**
 - U.S.C. 2006 Ed.
 - **Amendments by Acts of Congress**
 - Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)



United States Code of Laws (U.S.C.)

- ☞ 50 Titles in U.S.C.
- ☞ **Title 23 Highways**
- ☞ Chapter 1 Federal-Aid System
 - Section 104 Apportionment
 - **Section 106 Stewardship and Oversight**
 - Section 144 Highway Bridge Program
 - Section 151 National Bridge Inspection Program
- ☞ **Chapter 5 Research, Deployment and Education**

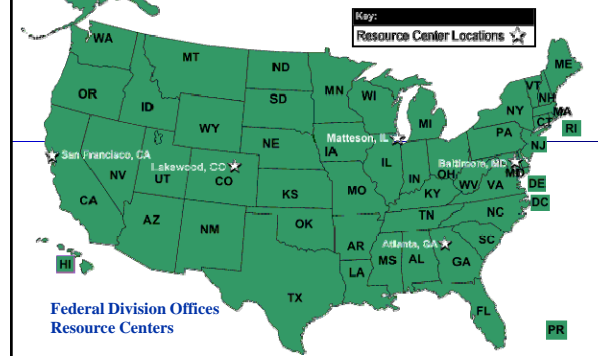


Stewardship and Oversight

- ☞ Shared responsibilities of FHWA and States
- ☞ **Stewardship – working together to do the right things efficiently and effectively.**
- ☞ **Oversight – making sure the right things are done right in compliance with laws, policies, rules and regulations, and agreements.**
 - Safety
 - Financial Integrity
 - Project Delivery



The FHWA Organization and the State DOTs



Code of Federal Regulations (CFR)

- ☞ Federal Agencies carry out the laws
- ☞ **General and Permanent Rules and Regulations codified in CFR by Federal Agencies**
 - CFR Published in Federal Register.
 - Revisions and Changes by Public Rulemaking Process
- ☞ 50 Titles in CFR
- ☞ Title 23 Highways



Public Rulemaking Process

- ☞ Purpose: Inform and receive comments from the public of proposed rules.
- ☞ Process:
 - ☞ Advance Notice of Proposed Rulemaking
 - ☞ **Notice of Proposed Rulemaking**
 - ☞ Public Comment Period – 30 to 180 days
 - ☞ **Final Rule**
 - ☞ Effective Date
 - ☞ Example: National Tunnel Inspection Standards



Act and Year	HBRRP Funding in \$ Billion		
	Period	Total	Ave. /Yr
Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA)	1992-1997 (6 years)	\$16.1	\$2.7
Transportation Equity Act for the 21 st . Century (TEA-21)	1998-2003 (6 years)	\$20.4	\$3.4
Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users of 2005 (SAFETEA-LU)	2005-2009 (5 years)	\$21.6	\$4.3
Consolidated Appropriations Act of 2008	2008	\$1.0	\$1.0

American Recovery and Reinvestment Act of 2009 (ARRA)

- ☞ Signed into law on February 17, 2009
- ☞ **\$787 billion total investment in creating jobs and economic recovery**
- ☞ **\$48.12 billion for transportation**
- ☞ **\$27.5 billion for highways**
 - 13,300 projects obligated
 - 5,800 projects under construction
 - 6,500 projects completed

ARRA Summary Highway Bridge Projects

Type of Project	ARRA Funds \$	No. of Projects
New Bridge Construction	598,816,000	65
Bridge Replacement	1,408,951,000	652
Bridge Improvement	1,176,389,000	557

TIGER PROGRAM

Transportation Investment Generating Economic Recovery

- ☞ Investment in infrastructure:
 - “An America Built to Last”!
- ☞ Job creation and economic recovery
- ☞ Safety and State of Good Repair
- ☞ Economic Competitiveness
- ☞ Livability
- ☞ Environmental Sustainability

TIGER GRANTS

Year	No. of Projects	No. of States Awarded Grants	Total Value
2009	51	50 + DC	\$1.5 B
2010	75	40	\$600 M
2011	46	33 + PR	\$511 M
2012 New	For information on application, visit www.dot.gov/TIGER		\$500 M Available

The Highway Bridge Program

- ☞ Replacement and Rehabilitation
- ☞ Painting
- ☞ Seismic Retrofit
- ☞ Systematic Preventive Maintenance
- ☞ Scour Countermeasures

The Highway Bridge Program

- ☞ Off-System Bridges
 - Outside Federal-Aid System
 - On Public Roads
 - No less than 15% HBP Funds



The Highway Bridge Program

- ☞ Bridge Set-Aside
 - The Golden Gate Bridge
 - The Hoover Dam Bridge
 - The Mississippi River Bridge
 - Others



Other Bridge Programs

- ☞ The Bridge Inspection Program
 - National Bridge Inspection Standards
 - National Bridge Inventory
- ☞ National Historic Covered Bridge Preservation Program
- ☞ Highways For Life Pilot Program
- ☞ Federal Lands Highways Program



Research & Deployment Programs

Program	Expected Outcomes
Innovative Bridge Research & Deployment	State Projects
High Performing Steel Bridge Research and Technology Transfer	Improve HPS Performance
Steel Bridge Testing	Inspection
High Performance Concrete Technology	Improve HPC Performance
Ultra High-Performance Concrete	Advance Conc. Technology
Long-Term Bridge Performance Program	Collect Data on Performance

Training

- ☞ Training Courses, Workshops and Conferences
 - Structural, Geotechnical and Hydraulic Engineering
- ☞ National Highway Institute (NHI) develops and delivers the courses
- ☞ Office of Bridge Technology organizes and sponsors workshops and conferences



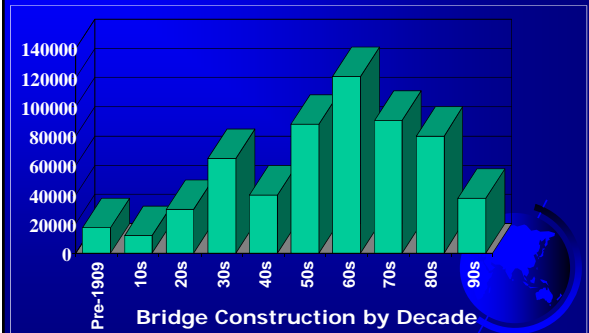
Important Websites

- ☞ www.fhwa.dot.gov/bridge
Information on bridge technologies
- ☞ www.fhwa.dot.gov/research
Research programs at FHWA Highway Research Center
- ☞ www.nhi.fhwa.dot.gov
Training courses on bridge engineering
- ☞ www.transportation.org/publications/bookstore.nsf/
AASHTO publications



Challenges and Opportunities in Bridge Engineering

Aging Infrastructure



Challenges in Preserving Existing Bridges



Construction Problems



Construction Accidents

Construction Problems



Human Factors



Human Factors



Human Factors



Human Factors



Forces of Nature - Earthquakes



Collapse of Interchanges



Forces of Nature



Forces of Nature



Forces of Nature

Extensive Corrosion



Corroded strands



Corroded PT tendons



“Close calls”



Column supporting a fracture critical cross beam on an Interstate bridge.

Buckled gusset plate on a fracture critical truss.



Collapses

Loads related events



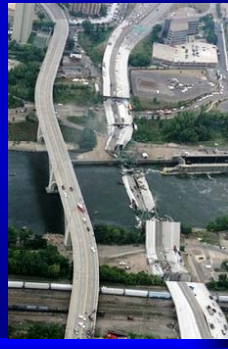
Collapse

Boston Central Artery/Tunnel Project
I-90 Tunnel Suspended Ceiling
July 2006



Collapse

I-35 W Bridge Failure



Bridge Technologies

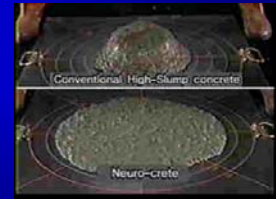
High-Performance Concrete

- ☞ High Strength – 10,000 psi
- ☞ Higher Modulus of Elasticity
- ☞ Freeze-Thaw Resistant
- ☞ Low Chloride Permeability



Self-Consolidating Concrete (SCC)

- ☞ No vibration needed
- ☞ Less noise
- ☞ Faster construction
- ☞ Improved quality and durability
- ☞ High strength



Good HPC,
But poor
consolidation!



Voids in Drilled Shafts

Ultra High-Performance Concrete (UHPC)

- ☞ Stronger
- ☞ More durable
- ☞ Faster construction

Ultra High-Performance Concrete (UHPC)



Testing a UHPC Bridge at the FHWA Turner-Fairbank Highway Research Center

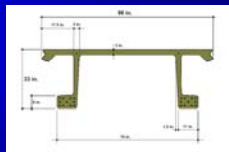


Ultra High-Performance Concrete (UHPC)

- ☞ Compressive Strength = 30,000 psi
- ☞ Tensile Strength = 1,000 psi
- ☞ Resistance to Road Salt = 100 times better
- ☞ Freeze-Thaw Resistance = 2 times better

Ultra High-Performance Concrete (UHPC)

- ☞ Cost = 10 times more!



- ☞ Challenge = Optimize Section; Minimize Structure

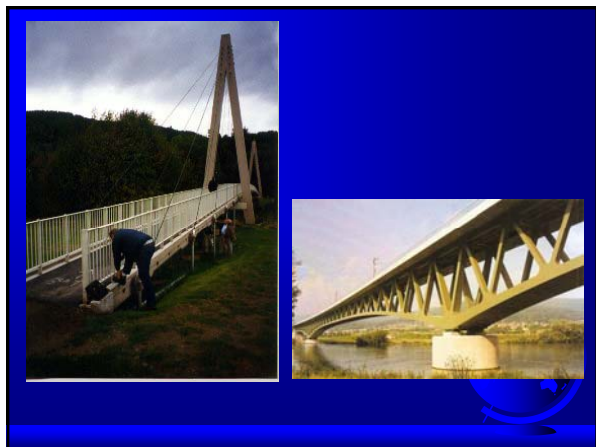
High-Performance Steel

- ☞ High Strength – 70,000 – 100,000 psi
- ☞ Corrosion Resistant
- ☞ Improved Weldability
- ☞ High Toughness



FRP ADVANTAGES

- ☞ Ease in Fabrication, Manufacturing, Handling, and Erection
- ☞ Short Project Time Delivery
- ☞ High Performance
- ☞ Durable
- ☞ Strength-to-Weight Ratio

Hybrid Composite Beams










Bridge Design and Construction

- ☞ AASHTO LRFD Bridge Design and Construction Specifications
 - By the American Association of State Highway and Transportation Officials
- ☞ State Standards for Road and Bridge Construction
 - By the State Departments of Transportation
- ☞ Project Specific Design Criteria and Special Provisions



Improving Bridge Safety

- ☞ *Framework for Improving Resilience of Bridge Design*
 - FHWA-IF-11-016
 - A copy of the Framework may be downloaded from:




<http://www.fhwa.dot.gov/bridge/pubs/hif11016/hif11016.pdf>

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Bridge Inspection and Management

- ☞ National Bridge Inspection Standards (NBIS)
- ☞ Recording and Coding Guide
- ☞ Bridge Management Systems (BMS)
 - PONTIS – AASHTOWares maintained by AASHTO
- ☞ Bridge Preservation Program
 - FHWA Bridge Preservation Guide.



Bridge & Tunnel Inspection

Visual and NDE Methods



Opportunities for Creative Designs



Opportunities for Sustainable Designs



Eco-logical Approach



Exemplary Ecosystem Program



Challenges and Opportunities are Waiting for You!



Enjoy your study!

Dream big dreams, and keep them alive through dedication, commitment and hard work!

Many of my dreams came true!
Your dreams will come true too!



Leisure Reading

- Whitney, C.S., "Bridges - Their Art, Science and Evolution", Greenwich House, New York, 1983
- Petroski, H., "Engineers of Dreams: Great Bridge Builders and the Spanning of America", eBook, Vantage Books, NY 1996.
- Chen, W.F and Duan, L, Editors, "Bridge Engineering Handbook", CRC Press LLC, Florida, 2000

